REMARKS

In the final Office Action mailed November 27, 2006, the Examiner rejected all pending claims. The Examiner maintained these rejections in an Advisory Action mailed March 6, 2007. In the present Amendment, Applicants have amended independent Claim 38. Claims 38-41, 43-56, 105 and 106 are currently pending.

In addition, Applicants have submitted herewith the Declaration of Cornelius A. van der Jeugd, which includes a material safety data sheet for trisilane. Applicants respectfully request entry of the amendments and full consideration of the attached documents and remarks contained herein.

Amendments to the Claims

Applicants have amended the claims to further clarify the subject matter that Applicants regard as the invention. Independent Claim 1 has been amended to recite that the "silicon-containing compound layer has a thickness non-uniformity of about 5% or less and a step coverage of about 80% or greater." Support for this language can be found in the Application, *e.g.,* pp. 31-32, as originally filed. Accordingly, Applicants respectfully submit that the amendment adds no new matter and is fully supported by the application as originally filed.

Rejections Under 35 U.S.C. §103

The Examiner has rejected Claims 38-41, 43-56, 105 and 106, as being obvious over U.S. Patent Application Publication No. 2003/0059535 (Luo *et al.*) in view of U.S. Patent No. 6,252,295 (Cote *et al.*), so-called "Admitted Prior Art" (APA) or U.S. Patent No. 6,503,846 (Niimi *et al.*), and further in view of U.S. Patent No. 4,363,828 (Brodsky *et al.*). Applicants note that Luo *et al.* has been asserted to teach the general features of independent Claim 38, but not use of trisilane. Cote *et al.* is asserted to satisfy this deficiency. Brodsky *et al.* is asserted to provide a motivation to combine the trisilane disclosed by Cote *et al.* with the process of Luo *et al.* "Admitted Prior Art" and Niimi *et al.* are asserted to disclose features of various dependent claims.

While Applicants do not acquiesce in the Examiner's rejections and assertions, Applicants have nevertheless amended the claims to expedite prosecution. The sole independent

claim, independent Claim 38, has been amended to recite forming a silicon compound layer having "a thickness non-uniformity of about 5% or less and a step coverage of about 80% or greater."

Applicants respectfully submit that the claims, as amended herewith, distinguish the art of record.

A. The Declaration of Cornelius A. van der Jeugd is Evidence Showing the Perspective of the Skilled Artisan.

To establish obviousness, it is well-established that "[b]oth the suggestion [to combine] and the expectation of success, must be founded in the prior art, not in the applicant's disclosure." *In re Dow Chemical Co.*, 5 U.S.P.Q.2d 1529, 1530 (Fed. Cir. 1988) The "reasonable expectation of success is assessed from the perspective of the person of ordinary skill in the art." *See, e.g., Life Technologies v. Clontech Laboratories*, 224 F.3d 1320, 56 U.S.P.Q.2d 1186 (Fed. Cir. 2000).

For this purpose, Applicants have submitted the Declaration of Cornelius A. van der Jeugd Under 37 C.F.R. § 1.132 (the Declaration). Cornelius A. van der Jeugd is an expert in chemical vapor deposition processes and discusses the perspective of the skilled artisan in the Declaration. The Declaration was previously filed in U.S. Application No. 11/213,449, which claims priority to the present Application. The Declaration discusses the use of trisilane to form high quality silicon compound layers, such as recited in the present claims. References which have been asserted in the present Application are also discussed. Thus, the Declaration is directly applicable to the present Application. Moreover, as evidence of the perspective of the skilled artisan, the Declaration must be evaluated as an "essential component[] of the obviousness determination." *In re Rouffet*, 149 F.3d 1350, 47 U.S.P.Q. 2d 1453 (Fed. Cir. 1998) (stating that "objective evidence of nonobviousness includes ... unexpected results ... and ***skepticism*** of skilled artisans before the invention") (emphasis added).

B. The Skilled Artisan Did Not Consider Trisilane to be an Equivalent to Silane and Disilane at the Time of the Invention; Rather, the Skilled Artisan Would Not Have Expected That Trisilane Could be Used Successfully in the Process of Luo *et al.* to Form High Quality Silicon Compound Layers.

The Examiner has stated that Luo *et al.* teaches a deposition process having the general features of Applicants' claimed cyclic process. Luo *et al.* is asserted to teach use of silane and disilane for its process, but is not asserted to teach trisilane. The Examiner asserted, however, that Cote *et al.* teaches that trisilane was an art-recognized equivalent for silane and disilane at the time of the invention. The Examiner further asserted that the skilled artisan would have substituted the silane and disilane of Luo *et al.* with trisilane to reduce processing time, because Brodsky *et al.* teaches that trisilane has a higher deposition rate.

Applicants note that Luo *et al.*'s process is directed to forming high quality films. Luo *et al.*, ¶ [0027]. As explained in the Declaration, trisilane has been considered unsuitable for depositing high quality films, such as desired by Luo *et al.*

Trisilane has been known to be a highly reactive silicon material, which is significantly more reactive than silane or disilane. For example, trisilane can detonate in air. Trisilane's high reactivity would have been expected to result in violent reactions with a substrate, leading the trisilane to deposit silicon uncontrollably on the substrate. Declaration, *e.g.*, ¶¶ 4 and 6.

The high reactivity would also have been expected to cause depletion effects. Trisilane entering a reaction chamber would have been expected to react violently with surfaces closest to the entry point of the trisilane, thereby reducing the trisilane concentration in the chamber as the distance from the entry point increases. Consequently, uneven deposition would have been expected to result, as portions of the substrate farther away from the inlet would have been expected to be exposed to a lower concentration of trisilane than portions of the substrate closer to the inlet, causing less deposition on those farther away portions. Declaration, *e.g.*, ¶ 6.

The high reactivity would also have been expected to result in gas phase reactions. These reactions would have been expected to cause gas phase agglomeration of materials, which would have been expected to fall onto the substrate surface. These masses of material would have been expected to disturb the uniformity and conformality of deposited films. Declaration, *e.g.*, ¶ 6.

In summary, the skilled artisan would not have expected trisilane to be equivalent to silane and disilane, especially in view of the violent reactivity of trisilane. Indeed, the violent reactivity, depletion effects, and gas phase reactions expected from trisilane would have been expected to cause poor conformality and uniformity for deposited films. Declaration, *e.g.*, ¶ 6. As a result, the skilled artisan would not have expected that trisilane could be used successfully to deposit high quality layers, especially in a cyclic process in which thin layers are sequentially built up to a desired thickness. Declaration, *e.g.*, ¶¶ 6-15. As discussed further below, the art of record would not have countered this skepticism. Consequently, the Examiner has not established a reasonable expectation of success and, so, has not established a *prima facie* case of obviousness with respect to independent Claims 1 and 25. *See In re Dow Chemical Co.*, 5 U.S.P.Q.2d at 1530 (to establish obviousness, the "expectation of success, must be founded in the prior art").

In the face of this skepticism, Applicants have successfully developed a process which advantageously allows the formation of silicon compound layers having a thickness non-uniformity of about 5% or less and a step coverage of about 80% or greater, even for layers which are about 3-30 Å thick. Moreover, Applicants have found that the highly uniform and conformal thin silicon layers advantageously allow for more complete reactions with reactants to form silicon compounds, without damaging underlying structures. The skilled artisan would have considered these results to be unexpected in view of the skepticism in the art. Declaration, *e.g.*, ¶ 8-10.

C. The Art of Record Does Not Counter the Skepticism of the Skilled Artisan.

The art of record, including Cote *et al.* and Brodsky *et al.*, would not have countered the skepticism of the skilled artisan.

Applicants note that Brodsky *et al.* discusses the bulk deposition of amorphous silicon, in which large amounts of silicon material are deposited in a short time. Trisilane is mentioned as a possible alternative to disilane. Brodsky *et al.* does not teach that it was concerned with forming high quality layers, nor does it teach that highly conformal or uniform layers could be formed using trisilane. In view of this silence, and of the pre-existing skepticism in the art, the skilled artisan would not have understood Brodsky *et al.*'s brief mention of trisilane to be an assertion that trisilane could be successfully used to form high quality layers, including the highly uniform

and conformal silicon layers recited in the pending claims. Brodsky *et al.* simply provides no teachings that counter the pre-existing skepticism of the skilled artisan.

Cote *et al.* is similarly deficient. Cote *et al.* merely provides a laundry list of silicon-containing gases, with silane, disilane and trisilane contained in the list. As noted in the Declaration, trisilane has been long known as a theoretical silicon precursor. Declaration, ¶ 5. However, this knowledge has been coupled with the expectations of the skilled artisan, as discussed above. Cote *et al.*'s further acknowledgement of the existence of trisilane does not alter these expectations. Cote *et al.* contains no discussion of the uniformity and conformality of the layers that may be formed using trisilane, nor does Cote *et al.* teach that trisilane is suitable for use in any and all applications in which silane and disilane are used. In view of the lack of any teachings which address the concerns of the skilled artisan, Cote *et al.* would not have alleviated the skilled artisan's skepticism regarding using trisilane to form high quality layers. Declaration, *e.g.*, ¶ 11. Applicants further submit that none of the other art of record, including APA and Niimi *et al.*, counter the skepticism of the skilled artisan.

Thus, Applicants respectfully submit that the art of record does not establish a *prima facie* case of obviousness. None of the art of record provides a reasonable expectation of success for using trisilane to form high quality silicon compound layers, including layers having a "thickness non-uniformity of about 5% or less and a step coverage of about 80% or greater," as recited in independent Claim 38. Rather, the skilled would have been skeptical of using trisilane to form high quality layers in Applicants' cyclic deposition process. In the face of this skepticism, Applicants have developed a cyclic process which has achieved the unexpected result of high conformality and high uniformity. As a result, Applicants submit that the pending claims are non-obvious over the art of record.

Accordingly, Applicants respectfully submit that the pending claims are allowable over the art of record. Furthermore, any remarks in support of patentability of one claim should not be imputed to any other claim, and any remarks based on a portion of a claim should not be taken as founding patentability on that portion. Rather, it is intended that patentability rests on the claim as a whole. Moreover, any such remarks which do not quote the claim portion verbatim should not be used to vary the meaning of the claim, as such are intended as a convenience to improve readability.

If not expressly addressed herein, Applicants respectfully traverse each of the Examiner's rejections and assertions as to what the prior art shows or teaches, alone or in combination. Although amendments and cancellations have been made, no acquiescence or estoppel is or should be implied hereby. Rather, such have been made to expedite prosecution and are without prejudice to assertion of such subject matter in future applications.

CONCLUSIONS

In view of the foregoing remarks, Applicants submit that the application is in condition for allowance and request the same. If some issue remains that the Examiner feels may be addressed by Examiner's amendment, the Examiner is invited to call the undersigned for authorization.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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